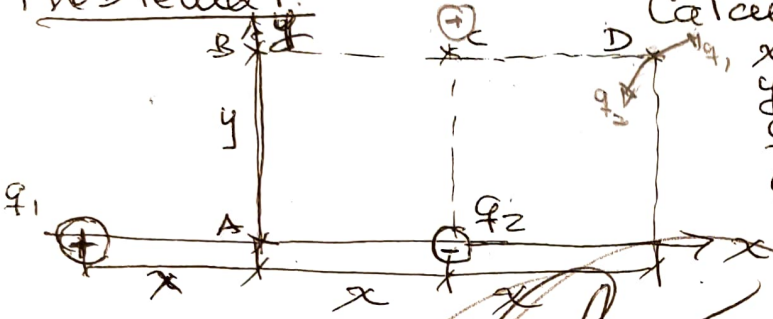
UNIVERSIDAD NACIONAL AUTÓNOMA DE ...
FACULTAD DE INGENIERIA
DIVISION DE CIENCIAS BASICAS
DEPARTAMENTO DE FISICA
ELECTRICIDAD Y MAGNETISMO
PRIMER EXAMEN PARCIAL

- MARZO - 2019
- Murrieta Villegas Alfonso
- 6:01

Problema 1.-



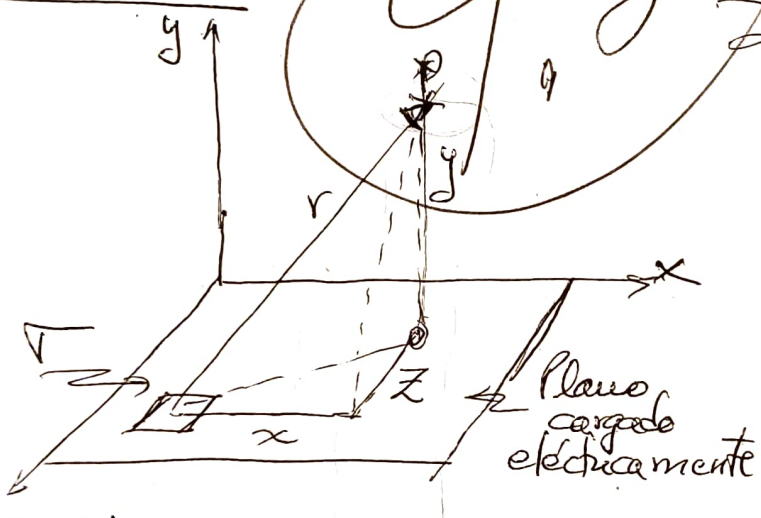
Calcular

$x = 10\,cm$
$y = 15\,cm$
$q_1 = 4\times10^{-8}\,Coul$
$q_2 = -6\times10^{-8}\,Coul$
$q_{prueba} = 3\times10^{-8}\,Coul$

Calcular

$E_A = ?$ $F_{P_A} = ?$
$E_B = ?$ $F_{P_B} = ?$
$E_C = ?$ $F_{P_C} = ?$
$E_D = ?$ $F_{P_D} = ?$

Problema 2.-



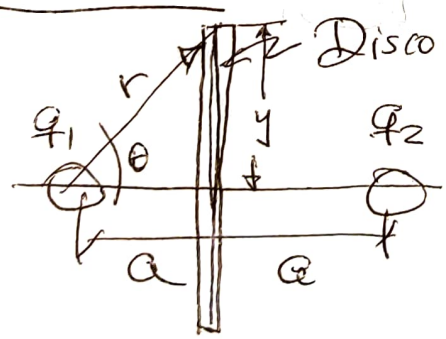
Demostrar que:

$$E = \frac{\sigma}{2\varepsilon_0}$$

a) Por Ley de Coulomb

b) Por Ley de Gauss

Problema 3

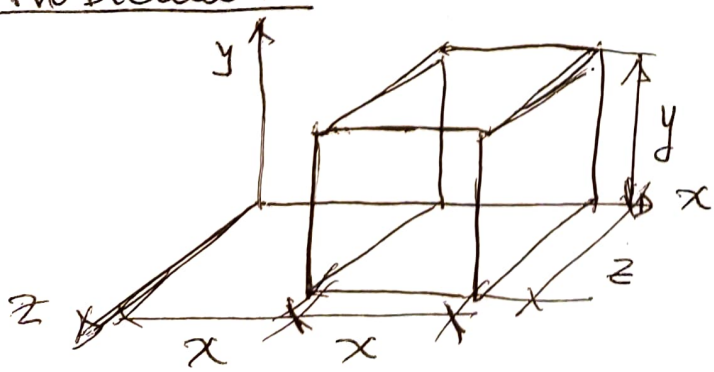


$q_1 = q_2 = q$

Demostrar que

$$N = \frac{q}{\varepsilon_0}(1-\cos\theta)$$

Problema 4



$x = 10\,cm$
$y = 10\,cm$
$z = 10\,cm$

$E_x = 10^3 x^{\frac{1}{3}}$
$E_y = 2\times10^3 y^{\frac{1}{3}}$
$E_z = 3\times10^3 z^{\frac{1}{3}}$
$P_1 = (15, 3, 6)\,cm$
$P_2 = (25, 15, 12)\,cm$
$P_3 = (5, 3, 6)\,cm$

Calcular:

a) Nuevo que cruza el cubo

b) Flujo tot. = ?

c) $\rho_1 = ?$
$\rho_2 = ?$
$\rho_3 = ?$

UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

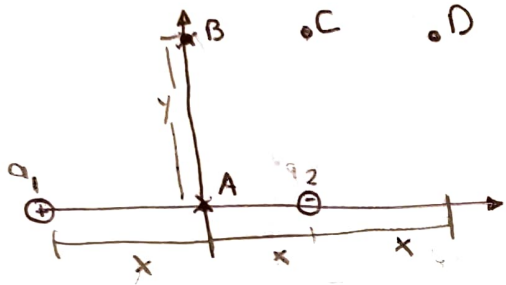
EXAMEN: 1° Examen

PROFESOR: Agustín Pérez Contreras

MATERIA: Electricidad y Magnetismo

NOMBRE DEL ALUMNO: Morrieta Villegas Alfonso

▸Problema 1]



DATOS

$x = 10$ [cm]

$y = 15$ [cm]

$q_1 = 4 \times 10^{-8}$ [C]

$q_2 = -6 \times 10^{-8}$ [C]

$q_{Prueb} = 3 \times 10^{-8}$ [C]

Calcular

- $E_A =$
- $E_B =$
- $E_C =$
- $E_D =$
- $F_{PA} =$
- $F_{PB} =$
- $F_{PC} =$
- $F_{PD} =$

▸Punto A

$$\bar{F}_{PA} = \bar{F}_{PAq_1} + F_{PAq_2} \; ; \; \bar{F}_{PA} = \frac{k(q_1)(q_{PA})}{r^2}[i] + \frac{k(-q_2)(q_{PA})}{r^2}[-i]$$

// Sustituyendo

$$\bar{F}_{PA} = \frac{(9\times10^9)(4\times10^{-8})(3\times10^{-8})}{(.1)^2}[i] + \frac{(9\times10^9)(-6\times10^{-8})(3\times10^{-8})}{(.1)^2}[-i] =$$

$$= 1.08\times10^{-3}[i] - 1.62\times10^{-3}[-i] = 2.7\times10^{-3}[\hat{i}]\ [N]$$

▸Punto B

$$\bar{F}_{PB} = \bar{F}_{PBq_1} + \bar{F}_{PBq_2}.$$

- $r = \sqrt{x^2+y^2} = \frac{\sqrt{13}}{20}$

- $\bar{F}_{PBq_1}$; $\bar{F}_{PBq_1x} = \frac{(k)(q_1)(q_{PBx})}{r^2}\left(\frac{x}{r}\right)[\hat{i}] = 1.843311\times10^{-4}[\hat{i}]$

$$\bar{F}_{PBq_1y} = \frac{(k)(q_1)(q_{PBy})}{r^2}\left(\frac{y}{r}\right)[\hat{j}] = 2.764967\times10^{-4}[\hat{j}]$$

- $\bar{F}_{PBq_2}$; $\bar{F}_{PBq_2x} = \frac{(k)(q_2)(q_{PBx})}{r^2}\left(\frac{x}{r}\right)[\hat{i}] = 2.764967\times10^{-4}[\hat{i}]$

$$\bar{F}_{PBq_2y} = \frac{(k)(q_2)(q_{PBy})}{r^2}\left(\frac{y}{r}\right)[-\hat{j}] = -4.147450\times10^{-4}[\hat{j}]$$

$\therefore \bar{F}_{PB} = \bar{F}_{PBq_1} + \bar{F}_{PBq_2} = 4.608278 \times 10^{-4}[\hat{i}] - 1.382478 \times 10^{-}$

▸ Punto C

$\bar{F}_{PC} = \bar{F}_{PCq_1} + \bar{F}_{PCq_2}$ $\qquad r = \sqrt{(2x)^2 + y^2} = \frac{1}{4}$

• $\bar{F}_{PCq_1}$; $F_{PCq_1x} = \frac{(k)(q_1)(q_{PBx})}{r^2}\left(\frac{x}{r}\right)[\hat{i}] = 1.3824 \times 10^{-4}[\hat{i}]$ $\quad x^2 = 2x$ ↑ distancia

$F_{PCq_1y} = \frac{(k)(q_1)(q_{PBy})}{r^2}\left(\frac{y}{r}\right)[\hat{j}] = 1.0368 \times 10^{-4}[\hat{j}]$

• $\bar{F}_{PCq_2}$; $F_{PCq_2x} = 0$ //No hay componente en x

$F_{PCq_2y} = \frac{(k)(q_2)(q_{PBy})}{r^2}[\hat{j}] = -7.2 \times 10^{-4}[\hat{j}]$

$\therefore \bar{F}_{PC} = 1.3824 \times 10^{-4}[\hat{i}] - 6.1632 \times 10^{-4}[\hat{j}]$ [N] //

▸ Punto D

$\bar{F}_{PD} = \bar{F}_{PDq_1} + \bar{F}_{PDq_2}$ $\qquad // r_{q_1} = \sqrt{(.3)^2 + (.15)^2} = .3354101$ $\quad // r_{q_2} = \sqrt{(.1)^2 + (.15)^2} = .1802775$

• $\bar{F}_{PDq_1}$; $F_{PDq_1x} = \frac{(k)(q_1)(q_{PBx})}{r^2}\left(\frac{x}{r}\right)[\hat{i}] = 8.586508 \times 10^{-5}[\hat{i}]$

⊕→ ⊕→ $\quad F_{PDq_1y} = \frac{(k)(q_1)(q_{PBy})}{r^2}\left(\frac{y}{r}\right)[\hat{j}] = 4.293254 \times 10^{-5}[\hat{j}]$

• $\bar{F}_{PDq_2}$; $F_{PDq_2x} = \frac{(k)(q_2)(q_{PBx})}{r^2}\left(\frac{x}{r}\right)[-\hat{i}] = 2.76497 \times 10^{-4}[-\hat{i}]$

⊕ ⊖ $\quad F_{PDq_2y} = \frac{(k)(q_2)(q_{PBx})}{r^2}\left(\frac{y}{r}\right)[-\hat{j}] = 4.147455 \times 10^{-5}[-\hat{j}]$

$\therefore \bar{F}_{PD} = -1.90631633 \times 10^{-4}[\hat{i}] - 3.71 \times 10^{-4}[\hat{j}]$ [N] //

// Obteniendo Campos $\quad E = \frac{1}{q}F$

$E_A = \frac{1}{3 \times 10^{-8}}(2.7 \times 10^{-3}\,\hat{i}) = 90 \times 10^{3}[\hat{i}]\left[\frac{N}{C}\right]$ //

$E_B = \frac{1}{3 \times 10^{-8}}[4.608278 \times 10^{-4}\,\hat{i} - 1.382478 \times 10^{-4}\,\hat{j}] = 15360.92[\hat{i}] - 4608.26[\hat{j}]\left[\frac{N}{C}\right]$ //

$E_C = \frac{1}{3 \times 10^{-8}}[1.3824 \times 10^{-4}\,\hat{i} - 6.1632 \times 10^{-4}\,\hat{j}] = 4608[\hat{i}] - 20541.1[\hat{j}]\left[\frac{N}{C}\right]$ //

$E_D = \frac{1}{3 \times 10^{-8}}[-1.9063 \times 10^{-4}\,\hat{i} - 3.71 \times 10^{-4}\,\hat{j}] = -6354.3[\hat{i}] - 12366.66[\hat{j}]\left[\frac{N}{C}\right]$ //

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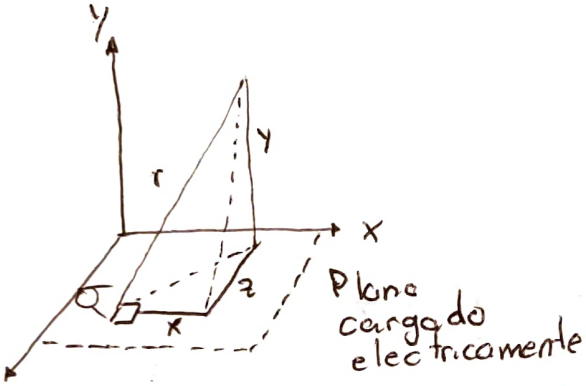
▶ Problema 2:



Demostrar que

$$E = \frac{\sigma}{2\varepsilon_0}$$

a) Ley de Coulomb

b) Ley de Gauss

COULOMB

▶ $E = d? \; ; \; E = E_y [\hat{j}]$

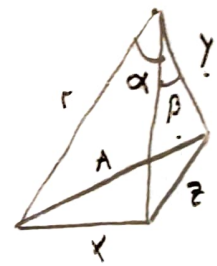
$dE_x \; ; \; E_x = \int dE_x \overset{0}{=} 0$

$dE_y \; ; \; E_y = \int dE_y \neq 0$

$dE_z \; ; \; E_z = \int dE_z \overset{0}{=} 0$

• $\sigma = \frac{dq}{dA} \; ; \; dq = \sigma dA$

• $E = k \frac{q}{r^2} [r u] \; ; \; dE = k \frac{dq}{r^2} [r u] = k \frac{\sigma dA}{r^2} [r u]$



$$dE_y = dE \cos\theta = k \frac{\sigma dx\, dz}{r^2} \left(\frac{y}{r}\right) [\hat{j}]$$

$$E_y = k\sigma y \int\int \frac{dx\, dz}{r^3} = k\sigma y \int dz \int \frac{dx}{r^3}$$

// Sustituyendo

• $\tan\alpha = \frac{x}{\beta} \; ; \; x = \beta \tan\alpha \; ; \; dx = \beta \sec^2\alpha\, d\alpha$

• $\cos\alpha = \frac{\beta}{r} \; ; \; r^3 = \beta^3 \sec^3\alpha$

$$= k\sigma y \int dz \int \frac{\beta \sec^2\alpha\, d\alpha}{\beta^3 \sec^3\alpha}$$

$$= k\sigma y \int \frac{dz}{\beta^2} \int \cos\alpha\, d\alpha =$$

$$= k\sigma y \int \frac{dz}{\beta^2} \operatorname{sen}\alpha \Big|_{-\pi/2}^{\pi/2} =$$

// Sustituyendo en $= k\sigma y \int \frac{dz}{\beta^2} \cancel{[1-(-1)]}^{2} =$

• $\tan\beta = \frac{z}{y} \; ; \; z = y \tan\beta \; ; \; dz = y \sec^2\beta\, d\beta$

• $\cos\beta = \frac{y}{\beta} \; ; \; \beta^2 = y^2 \sec^2\beta$

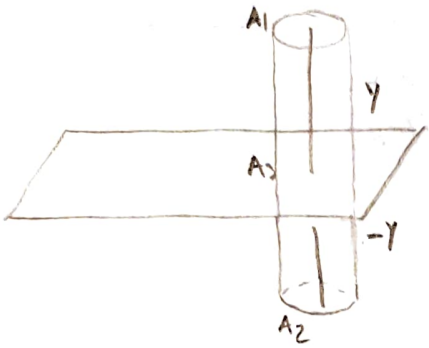
$$= 2k\sigma \cancel{y} \int \frac{\cancel{y} \sec^2\beta\, d\beta}{\cancel{y} \sec^2\beta} =$$

$$= 2k\sigma \int d\beta = 2k\sigma [\beta_2 - \beta_1] =$$

$\beta_2 = \frac{\pi}{2} \quad \beta_1 = -\pi/2$

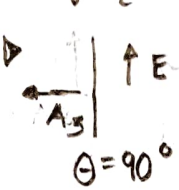
$$= 2k\sigma\left[\cancel{\frac{\pi}{2} - \left(-\frac{\pi}{2}\right)}\right]^{\pi} = 2\pi k\sigma\left[\frac{1}{j}\right] = \frac{\cancel{2}\cancel{\pi}\sigma}{\cancel{4}\cancel{\pi}\varepsilon_0} = \frac{\sigma}{2\varepsilon_0}$$

GAUSS



$$\int E_1\, dA \cancel{\cos\theta}^{1} = E\int dA = E_1 dA_1$$

$$\int E_2\, dA\cos\theta = E\int dA = E_2 dA_2$$



$$\int E_3\, dA\cos\theta = 0$$

- $\oint E\cdot dA = \frac{1}{\varepsilon_0} q_{neta}$ • $\sigma = \frac{dq}{dA}$; $dq = \sigma dA$; $q = \sigma A$

$A_1 = A_2$
$\therefore E_1 = E_2$

Misma Area y campo

$$\oint E\cdot dA = \int E_1 dA_1 + \int E_2 dA_2 + \cancel{\int E_3 dA_3}^{\,0}$$

$$\therefore \oint E\cdot dA = E_1A_1 + E_1A_1 = 2E_1A_1$$

$$\therefore\ 2E_1A_1 = \frac{1}{\varepsilon_0}q \ ;\ 2E_1\cancel{A_1} = \frac{1}{\varepsilon_0}\sigma\cancel{A} \ ;\ E = \frac{\sigma}{2\varepsilon_0}$$

2.0

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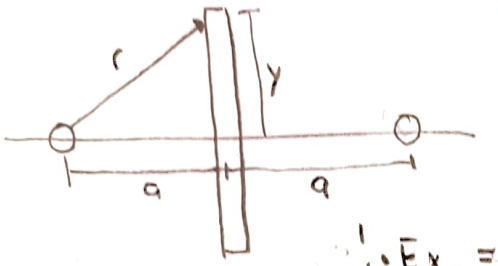
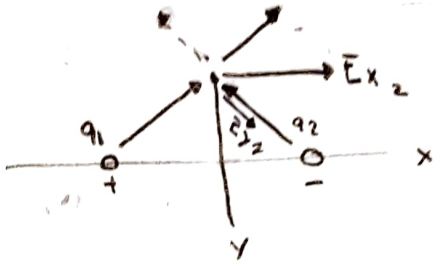
Problema 3



- $q_1 = q_2 = q$
- // Pero una positiva y otro negativa



- $E_1 = \frac{q}{r^2}\frac{1}{4\pi\varepsilon_0}$
- $E_2 = -\frac{q}{r^2}\frac{1}{4\pi\varepsilon_0}$

- $E_{x_1} = \frac{q}{4\pi\varepsilon_0 r^2}\left(\frac{a}{r}\right)[\hat{i}]$
- $E_{y_1} = \frac{q}{4\pi\varepsilon_0 r^2}\left(\frac{y}{r}\right)[\hat{j}]$
- $E_{x_2} = \frac{q}{4\pi\varepsilon_0 r^2}\left(\frac{a}{r}\right)[\hat{i}]$
- $E_{y_2} = \frac{q}{4\pi\varepsilon_0 r^2}\left(\frac{y}{r}\right)[-\hat{j}]$

$\therefore E_y = 0$

$E_x = \frac{1}{2\pi\varepsilon_0}\frac{qq}{r^3}$

$\therefore E = \frac{1}{2\pi\varepsilon_0}\frac{qq}{r^3}\hat{i}$

- $A = \pi y^2$

$dA = 2\pi y\,dy$

- $N = \int E\cdot dA = \int\left(\frac{qq}{r^3}\frac{1}{\cancel{2\pi}\varepsilon_0}\right)(\cancel{2\pi}y\,dy) = \int\frac{qq\,y\,dy}{\varepsilon_0 r^3} =$

// Sustituyendo

$y = a\tan\theta$

$dy = a\sec^2\theta\,d\theta$

$r = a\sec\theta$

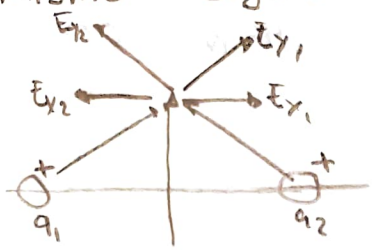
$= \int\frac{q}{\varepsilon_0}\frac{\cancel{a}\tan\theta\,\cancel{a}\sec^2\theta\,d\theta}{a^3\sec^3\theta} = \frac{q}{\varepsilon_0}\int\frac{\tan\theta}{\sec\theta}d\theta =$

$= \int\frac{\frac{\operatorname{sen}\theta}{\cos\theta}}{\frac{1}{\cos\theta}}d\theta = \frac{q}{\varepsilon_0}\int\operatorname{sen}\theta\,d\theta = \frac{q}{\varepsilon_0}\left[-\cos\theta\right]\Big|_0^\theta =$

$= \frac{q}{\varepsilon_0}\left[-\cos\theta + \overset{1}{\cos 0}\right] = \frac{q}{\varepsilon_0}\left[1-\cos\theta\right]$ //

2.0

* Para cargas iguales con mismo signo



$E_1 = \frac{q}{r^2}\frac{1}{4\pi\varepsilon_0}$

$E_2 = \frac{q}{r^2}\frac{1}{4\pi\varepsilon_0}$

- $E_{x_1} = \frac{q}{4\pi\varepsilon_0 r^2}\left(\frac{a}{r}\right)\left[\hat{i}\right]$
- $E_{y_1} = \frac{q}{4\pi\varepsilon_0 r^2}\left(\frac{y}{r}\right)\left(\hat{j}\right)$
- $E_{x_2} = \frac{q}{4\pi\varepsilon_0 r^2}\left(\frac{a}{r}\right)\left[\hat{i}\right]$
- $E_{y_2} = \frac{q}{4\pi\varepsilon_0 r^2}\left(\frac{y}{r}\right)\left[\hat{j}\right]$

▶ $E_y = \frac{1}{2\pi\varepsilon_0}\left(\frac{qy}{r^3}\right)$; $E = \frac{1}{2\pi\varepsilon_0}\frac{qy}{r^3}$

$E_x = 0$

▶ $A = \pi y^2$; $dA = \pi\, 2y\, dy$

▶ $N = \int E\cdot dA = \int\left(\frac{1}{2\pi\varepsilon_0}\frac{qy}{r^3}\right)\left(\pi\, 2y\, dy\right) = \frac{q}{\varepsilon_0}\int\frac{y^2}{r^3}dy$

// Sustituyendo

$y = a\tan\theta$

$dy = a\sec^2\theta\, d\theta$

$r = a\sec\theta$

$= \frac{q}{\varepsilon_0}\int\frac{a^2\tan^2\theta\, a\sec^2\theta\, d\theta}{a^3\sec^3\theta} = \frac{q}{\varepsilon_0}\int\frac{\tan^2\theta\, d\theta}{\sec\theta} =$

identidad

$\sec^2(x) - \tan^2(x) = 1$; $\tan^2 x = -1 + \sec^2 x$

$= \frac{q}{\varepsilon_0}\int\frac{-1+\sec^2\theta}{\sec\theta}d\theta = \frac{q}{\varepsilon_0}\left[-\int\frac{1}{\sec\theta}d\theta + \int\sec\theta\, d\theta\right] =$

$= \frac{q}{\varepsilon_0}\left[-\int\cos\theta\, d\theta + \int\sec\theta\, d\theta\right] =$

$= \frac{q}{\varepsilon_0}\left[-\operatorname{sen}\theta\Big|_0^\theta + \cancel{\ln|\tan\theta + \sec\theta|\Big|_0^\theta}\right] \neq$

$\therefore$ Si ambas cargas tienen misma carga eléctrica no se podría modelar mediante la expresión

$\neq \frac{q}{\varepsilon_0}\left[1 - \cos\theta\right]$ //

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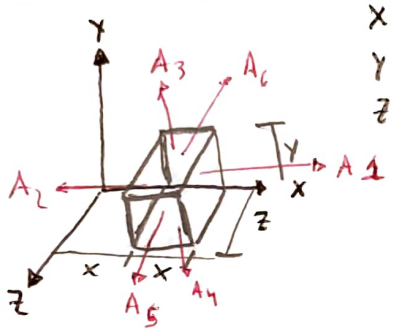
▶ Problema 4



DATOS

$x = .01$ [m]
$y = .01$ [m]
$z = .01$ [m]

- $E_x = 10^3 x^{\frac{1}{3}}$
- $E_y = 2 \times 10^3 y^{1/3}$
- $E_z = 3 \times 10^3 z^{1/3}$

$P_1(15, 3, 6)$ [cm]
$P_2(25, 15, 12)$ [cm]
$P_3(5, 3, 6)$ [cm]

- $dA_1 = dA[\hat{i}]$
- $dA_2 = dA[-\hat{i}]$
- $dA_3 = dA[\hat{j}]$
- $dA_4 = dA[-\hat{j}]$
- $dA_5 = dA[\hat{k}]$
- $dA_6 = dA[-\hat{k}]$

a) $N = \int E \cdot dA$

1) $N_1 = E_1 \int dA_1 = 10^3 x^{1/3}(.01) = 10^3 (.01)^{1/3}(.01) = 5.84$ [Lineas]

2) $N_2 = -E_2 \int dA_2 = -10^3 x^{1/3}(.01) = -10^3 (.01)^{1/3}(.01) = -4.6415$ [lineas] ¿?

3) $N_3 = E_3 \int dA_3 = 2 \times 10^3 y^{1/3}(.01) = 2 \times 10^3 (.01)^{1/3}(.01) = 9.2831$ [Lineas]

4) $N_4 = -E_4 \int dA_4 = -2 \times 10^3 y^{1/3}(.01) = -2 \times 10^3 (0)(.01) = 0$ [Lineas]

5) $N_5 = E_5 \int dA_5 = 3 \times 10^3 z^{1/3}(.01) = 3 \times 10^3 (.01)^{1/3}(.01) = 13.9247$ [Lineas]

6) $N_6 = E_6 \int dA_5 = -3 \times 10^3 z^{1/3}(.01) = -3 \times 10^3 (0)(.01) = 0$ [lineas]

$N_{Total} = N_1 + N_2 + \ldots + N_6 = 24.4143$ [Lineas]

20

b) $N = \frac{1}{\varepsilon_0} q$; $q = \varepsilon_0 N$

$\therefore q = (24.4143)(8.85 \times 10^{-12}) = 216.0665 \times 10^{-12}$ [C]

c) $(\nabla \cdot E) = \frac{1}{\varepsilon_0} \frac{dq}{dV}$; $\varepsilon_0 (\nabla \cdot E) = \rho$

$(\nabla \cdot E) = \left(\frac{dE_x}{dx} + \frac{dE_y}{dy} + \frac{dE_z}{dz} \right)$

$= \left(\frac{10^3}{3} x^{-2/3} + \frac{2 \times 10^3}{3} y^{-2/3} + \frac{3 \times 10^3}{3} z^{-2/3} \right)$

//Sostituyendo puntos y verificando

$\varepsilon_0 = 8.85 \times 10^{-12}$

▸ $P_1 (.15, .03, .06)$ [m]

$$\rho_1 = \varepsilon_0 \left(\frac{10^3}{3} (.15)^{-2/3} + \frac{2 \times 10^3}{3} (.03)^{-2/3} + \frac{3 \times 10^3}{3} (.06)^{-2/3} \right) =$$

$$= \varepsilon_0 (14.61047 \times 10^3) \left[\frac{C}{m^3}\right] = 1.293026 \times 10^{-7} \left[\frac{C}{m^3}\right]$$

▸ $P_2 (.25, .15, .12)$

$$\rho_2 = \varepsilon_0 \left(\frac{10^3}{3} (.25)^{-2/3} + \frac{2 \times 10^3}{3} (.15)^{-2/3} + \frac{3 \times 10^3}{3} (.12)^{-2/3} \right) =$$

$$= \varepsilon_0 (7.3117 \times 10^3) \left[\frac{C}{m^3}\right] = 6.4708545 \times 10^{-8} \left[\frac{C}{m^3}\right]$$

▸ $P_3 (.05, 0.03, .06)$

$$\rho_3 = \varepsilon_0 \left(\frac{10^3}{3} (.05)^{-2/3} + \frac{2 \times 10^3}{3} (.03)^{-2/3} + \frac{3 \times 10^3}{3} (.06)^{-2/3} \right) =$$

$$= \varepsilon_0 (15.8857 \times 10^3) \left[\frac{C}{m^3}\right] = 1.40588445 \times 10^{-7} \left[\frac{C}{m^3}\right]$$

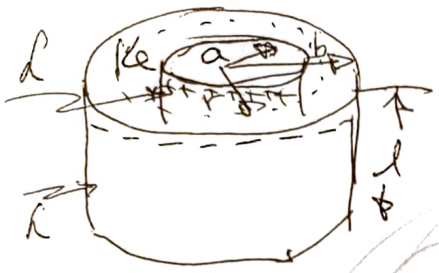
FACULTAD DE INGENIERIA
DIVISION DE CIENCIAS BASICAS
DEPARTAMENTO DE FISICA
ELECTRICIDAD Y MAGNETISMO
SEGUNDO EXAMEN PARCIAL

8-ABRIL-2019
10-ABRIL 2019

Grupo: 1
Examen: 2° - Parcial

→ Murrieta Villegas Alfonso

Problema 1



$V_{ab} = 500\,V$
$a = 2\,cm$
$b = 6\,cm$
$l = 15\,cm$
$K_e = 4$

Calcular
$E_a = ?$
$E_b = ?$
$E_{r_1} = ?$ si $r_1 = 4\,cm$
$V_{ab_0} = ?$
$E_{r_0} = ?$
$C = ?$
$C_0 = ?$
$E_{valen} = ?$
$E_{valen_0} = ?$
$R = ?$

$V_{ar_2} = ?$ si $r_2 = 8\,cm$
$V_{r_3b} = ?$ si $r_3 = 1\,cm$
$r_4 = ?$ para $V_{ar_4} = 350$ Volts
$r_5 = ?$ para $V_{ar_5} = 600$ Volts
$r_6 = ?$ para $V_{ar_6} = -200$ Volts

Problema 2

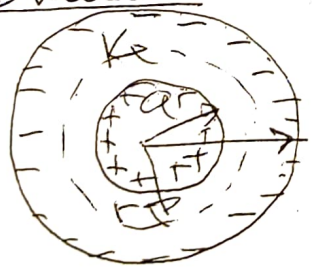
Demostrar que
$V_{ab} = Ed$

$V_{ab} = 500\,V$
$d = 10\,mm$
$A = 10\,cm^2$
$K_e = 4$

CALCULAR
$E = ?$
$\sigma = ?$
$E_0 = ?$
$V_{ab_0} = ?$
$C = ?$
$C_0 = ?$
$E_{valen} = ?$
$E_{valen_0} = ?$

$E_{x_1} = ?$ si $x_1 = 5\,mm$
$E_{x_2} = ?$ si $x_2 = 12\,mm$
$V_{ax_1} = ?$
$V_{ax_2} = ?$
si $V_{ax_3} = 300\,V$
$x_3 = ?$

Problema 3



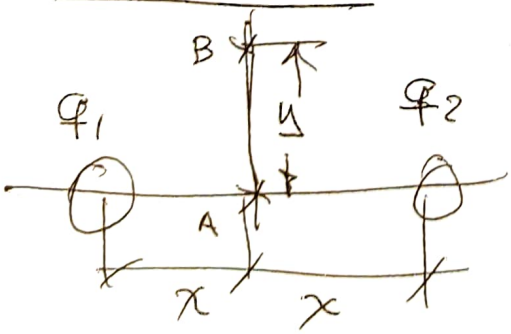
Demostrar que:
$$V_{ab} = \frac{1}{4\pi\varepsilon_0}\left(\frac{q}{a} - \frac{q}{b}\right)$$

$V_{ab} = 500\,V$
$a = 2\,cm$
$b = 6\,cm$
$K_e = 4$

CALCULAR
$q = ?$
$V_{ab_0} = ?$
$C = ?$
$C_0 = ?$
$E_{valen} = ?$
$E_{valen_0} = ?$

V_{ar_1} si $r_1 = 4\,cm$
V_{ar_2} si $r_2 = 8\,cm$
V_{br_3} si $r_3 = 1\,cm$
$r_4 = ?$ si $V_{ar_4} = 200\,V$
$r_5 = ?$ si $V_{ar_5} = 600\,V$

Problema 4



$q_1 = 2\times10^{-8}\,Coul$
$q_2 = -3\times10^{-8}\,Coul$
$x = 10\,cm$
$y = 15\,cm$

Calcular
$V_A = ?$
$V_B = ?$
$V_{AB} = ?$

ALUMNO
• Murrieta Villegas Alfonso

UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

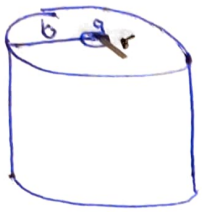
EXAMEN: 2° Examen Parcial

PROFESOR: Agustin Perez Contreras

MATERIA: Electricidad y Magnetismo

NOMBRE DEL ALUMNO: Murrieta Villegas Alfonso

1]



$V_{ab} = 500[V]$
$a = .02[m]$
$b = .06[m]$
$l = .15[m]$
$k_e = 4$
$r_1 = .04$

- $\cancel{E_\theta} =$
- $\cancel{E_\theta} =$
- $\cancel{E_{r_1}} =$
- $\cancel{V_{ab_0}} =$
- $\cancel{E_{r_{10}}} = d?$
- $\cancel{C} =$
- $\cancel{C_0} =$

$\cancel{E_{vatm}} =$
$\cancel{E_{vatm_0}} =$
$\cancel{\lambda} =$
- $V_{ar_2} = ?$ if $r_2 = .08[m]$
- $V_{r_3b} = ?$ if $r_3 = .01\ m$
- $\cancel{V_4} = ?$ if $V_{ar_4} = 350$ Volts
- $\cancel{V_5} = ?$ if $V_{ar_5} = 600$ Volts
- $\cancel{V_6} = ?$ if $V_{ar_6} = 200$ Volts

$$V_{ba} = -\int_a^b E \cdot ds$$

$$E = \frac{1}{2\pi\varepsilon}\frac{\lambda}{r} \qquad a \le r \le b$$

$E = [E_r, E_\theta, E_z]$
$ds = [dr, r\,d\theta, dz]$
$E = f(r) \qquad E_\theta = E_z = 0$

$$E \cdot ds = E_r \cdot dr \cos\theta^\circ$$

$$\therefore V_{ab} = \int_a^b \frac{1}{2\pi\varepsilon}\frac{\lambda}{r}\,dr = \frac{\lambda}{2\pi\varepsilon}\ln(r)\Big|_a^b = \frac{\lambda}{2\pi\varepsilon}\ln\left(\frac{b}{a}\right)$$

- $$\lambda = \frac{(V_{ab})(2\pi\varepsilon_0 k_e)}{\ln\left(\frac{b}{a}\right)} = \frac{(500)[2\pi(8.85\times10^{-12})(4)]}{\ln\left(\frac{.06}{.02}\right)} = 101.229\times10^{-9}$$

- $$\frac{V_{ab_0}}{V_{ab}} = k_e \;;\; V_{ab_0} = k_e(V_{ab}) = 4(500\,V) = 2000[V]$$

- $$C = \frac{q}{V_{ab}} = \frac{q}{\frac{\lambda}{2\pi\varepsilon}\ln\left(\frac{b}{a}\right)} = \frac{l\lambda}{\frac{\lambda}{2\pi\varepsilon}\ln\frac{b}{a}} = \frac{2\pi\varepsilon l}{\ln\left(\frac{b}{a}\right)}$$

$$= \frac{4(2\pi)(8.85\times10^{-12})(.15)}{\ln\left(\frac{.06}{.02}\right)} = 30.3689\times10^{-12}\ [CN]$$

$$\lambda = \frac{dq}{dl} = q = \lambda l$$

- $q = (.15)(101.2298\times10^{-9}) = 1.61849\times10^{-8}\ [C]$

- $$\frac{C}{C_0} = k_e \;;\; C_0 = \frac{C}{k_e} = \frac{30.3689\times10^{-12}}{4} = 7.5922\times10^{-12}\left[\frac{C}{V}\right]$$

- $E_{alm} = \frac{1}{2} C V_{ab}^2 = \frac{1}{2}(30.3689 \times 10^{-12})(500)^2 = 3.796 \times 10^{-6}$ [J]
- $E_{almo} = \frac{1}{2} C_o V_{ab_o}^2 = \frac{1}{2}(7.5922 \times 10^{-12})(2000)^2 = .5184 \times 10^{-8}$ [J]
- $E_a = \frac{1}{2\pi\varepsilon} \frac{\lambda}{a} = \frac{1}{(4)(2\pi)(8.85 \times 10^{-12})}\left(\frac{101.2298 \times 10^{-9}}{.02}\right) = 22{,}755.96$ [N/C]
- $E_b = \frac{1}{2\pi\varepsilon} \frac{\lambda}{b} = \frac{1}{(4)(2\pi)(8.85 \times 10^{-12})}\left(\frac{101.2298 \times 10^{-9}}{.06}\right) = 7585.32$ [N/C]
- $E_{r_1} = \frac{1}{2\pi\varepsilon} \frac{\lambda}{r_1} = \frac{1}{(4)(2\pi)(8.85 \times 10^{-12})}\left(\frac{101.2298 \times 10^{-9}}{.04}\right) = 11377.98$ [N/C]

→ $V_{ar_1} = \frac{\lambda}{2\pi\varepsilon} \ln\left(\frac{r}{a}\right)$; $\frac{V_{ab}}{\ln\left(\frac{b}{a}\right)} = \frac{V_{ar_1}}{\ln\left(\frac{r_1}{a}\right)}$; $\ln\left(\frac{r_1}{a}\right) = \frac{V_{ar_1}}{V_{ab}} \ln\left(\frac{b}{a}\right)$

$\ln(r_1) = \frac{V_{ar_1}}{V_{ab}} \ln\left(\frac{b}{a}\right) + \ln a$; $r_1 = e^{\left(\ln \frac{b}{a}\right)\left(\frac{V_{ar_1}}{V_{ab}}\right)} e^{\ln(a)}$

$r = a\left(\frac{b}{a}\right)^{\left(\frac{V_{ar_1}}{V_{ab}}\right)}$

- $r_4 = (.02)\left(\frac{.06}{.02}\right)^{\left(\frac{350}{500}\right)} = .04315$ [m]
- $r_5 = (.02)\left(\frac{.06}{.02}\right)^{\left(\frac{400}{500}\right)} = .0747$ [m] ✗ no existe
- $r_6 = (.02)\left(\frac{.06}{.02}\right)^{\left(\frac{200}{500}\right)} = .03103$ [m] ✗

- $V_{ar_2}^* = \frac{\lambda}{2\pi\varepsilon} \ln\left(\frac{r_2}{a}\right) = \frac{101.2298 \times 10^{-9}}{(4)(2\pi)(8.85 \times 10^{-12})} \ln\left(\frac{.08}{.02}\right) = 630.9293$ [V] 500V
- $V_{ar_3}^* = \frac{\lambda}{2\pi\varepsilon} \ln\left(\frac{r_3}{a}\right) = \frac{101.2298 \times 10^{-9}}{(4)(2\pi)(8.85 \times 10^{-12})} \ln\left(\frac{.06}{.01}\right) = 815.4643$ [V] 500V

NOTA | "V_{ar_2}" y "V_{ar_3}" al ser mayores a "b" los valores deben ser en ambos casos 500 [V]

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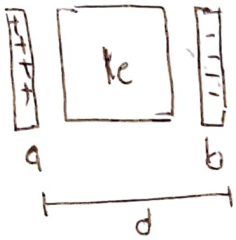
2]



Demostrar que $V_{ab} = Ed$

$V_{ab} = 500\,V$

$d = 10\ mm$

$A = 10\ cm^2$

$K_e = 4$

▶ CALCULAR

- $E =$
- $\sigma =$
- $E_0 =$
- $V_{ab_0} =$
- $C =$
- $C_0 =$
- $E_{ualm} =$
- $E_{ualm_0} =$
- $E_{x_1} =$ if $x_1 = 5\ mm$
- E_{x_2} if $x_2 = .12\ m$
- V_{ax_1}
- V_{ax_2}
- if $V_{ax_3} = 300$, $x_3 =$

$$E_0 = \frac{\sigma}{\varepsilon_0}\ ;\ \frac{E_0}{E} = k_e\ ;\ E = \frac{E_0}{k_e}$$

$$E = \frac{\sigma}{k_e \varepsilon_0}\ ;\ E = \frac{\sigma}{\varepsilon}\hat{i}$$

$$E = [E_x, E_y, E_z]$$
$$ds = [dx, dy, dz]$$

$$\therefore V_{ba} = -\int_a^b E \cdot ds = -\int_a^b E\,dx\cos\theta = -E\int_a^b dx = -E\underbrace{[x_b - x_a]}_{d} = -Ed$$

- $E = \frac{V_{ab}}{d}\ ;\ E = \frac{500}{.01} = 50 \times 10^3 \left[\frac{V}{m}\right]$

- $E = \frac{\sigma}{k_e \varepsilon_0}\ ;\ k_e \varepsilon_0 E = \sigma\ ;\ \sigma = (4)(8.85 \times 10^{-12})(50 \times 10^3) = 1.77 \times 10^{-6}$

- $E_0 = k_e E = (4)(50 \times 10^3) = 200 \times 10^3 \left[\frac{V}{m}\right]$

- $\frac{V_{ab_0}}{V_{ab}} = k_e\ ;\ V_{ab_0} = k_e V_{ab} = (4)(500) = 2000\,[V]$

- $C = \frac{q}{V_{ab}} = \frac{q}{Ed} = \frac{q}{\frac{\sigma}{\varepsilon}d} = \frac{q}{\frac{\frac{q}{A}}{\varepsilon}d} = \frac{\varepsilon A}{d} = \frac{(4)(8.85 \times 10^{-12})(.001)}{(.01)} =$
  $= 3.54 \times 10^{-12} \left[\frac{C}{V}\right]$

- $\frac{C}{C_0} = k_e\ ;\ C_0 = \frac{C}{k_e} = \frac{3.54 \times 10^{-12}}{4} = 8.85 \times 10^{-13} \left[\frac{C}{V}\right]$

- $E_{alm} = \frac{1}{2}CV^2 = \frac{1}{2}(3.54 \times 10^{-12})(500)^2 = 8.85 \times 10^{-7}\,[J]$

- $E_{alm_0} = \frac{1}{2}C_0 V_0^2 = \frac{1}{2}(8.85 \times 10^{-12})(2000)^2 = 1.416 \times 10^{-3}\,[J]$

- $E_{x_1} \mid x_1 = .005$

$$E_{x_1} = \frac{V_{ab}}{x_1} = \frac{500}{.005} = 100 \times 10^3 \left[\frac{V}{m}\right]$$

- $E_{x_2} \mid x_2 = .012$

$x > d \; ; \; E_{x_2} = 0$

- $V_{ax_1} = E_{x_1} = (50 \times 10^3)(.005) = 250 [V]$
- $V_{ax_2} = E_{x_2} = x_2 > d \; ; \; V_{ax_2} = V_{ab} = 500 [V]$
- $V_{ax_3} = E_{x_3}$

$$x_3 = \frac{V_{ax_3}}{E} = \frac{300}{50 \times 10^3} = 6 \times 10^{-3} [m]$$

1,5

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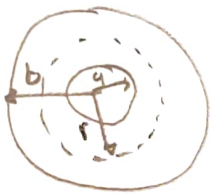
3) Demostrar que

$$V_{ab_0} = \frac{1}{4\pi\varepsilon_0}\left(\frac{q}{a} - \frac{q}{b}\right)$$

DATOS	CALCULAR	
$a = 2$ cm	• ~~q~~ =	• ~~E_{alm}~~ =
$b = 6$ cm	• ~~V_{ab_0}~~ =	• ~~E_{almo}~~ =
$k_e = 4$	• ~~e~~ =	• ~~V_{ar_1}~~ if $r_1 = 4$ cm
	• ~~ε_0~~ =	• V_{ar_2} if $r_2 = 8$ cm
		• V_{ar_3} if $r_3 = 1$ cm
		• r_4 if $V_{ar_4} = 200$[V]
		• r_5 if $V_{ar_5} = 600$[V]



Regiones - Campos

1] $0 \le r \le a \rightarrow E_1 = 0$

2] $a \le r \le b \rightarrow \frac{1}{4\pi\varepsilon}\cdot\frac{q}{r^2} = E_2$

3] $b > r \rightarrow E_3 = 0$

▸ Región 1

$E_1 = 0 \quad \oint E \cdot ds = 0$

if $E = 0 \quad V_e = 0$

$V_b = V_a$

▸ Región 3

$E_3 = 0 \quad \int_a^b E \cdot ds = V_b - V_a = 0$

$V_b = V_a$

→ Región 2

$$E_2 = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$$

• $E = [E_r, E_\theta, E_\varphi]$

• $ds = [dr, r d\theta, r d\varphi]$

• $E = f(r)$

• $E_\theta = E_\varphi = 0$

$\therefore E \cdot ds = E_r\, dr \cos\theta$; $V_b - V_a = -\oint E \cdot ds = -\int_a^b \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}dr$

$$V_{ba} = \frac{q}{4\pi\varepsilon_0} - \int_a^b \frac{dr}{r^2} = \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{r}\right)\Big|_a^b \; ; \; \cancel{V_{ba}} = \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{b} - \frac{1}{a}\right)$$

$$\therefore V_{ab} = \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{a} - \frac{1}{b}\right)$$

// Calculos

• $\frac{V_{ab_0}}{V_{ab}} = k_e$; $V_{ab_0} = (k_e)(V_{ab}) = (4)(500) = 2000$[V] //

• $C = k_e\left(\frac{4\pi\varepsilon_0}{\frac{1}{a} - \frac{1}{b}}\right) = \frac{(4\pi)(8.85 \times 10^{-12})(4)}{\frac{1}{.02} - \frac{1}{.06}} = 13.3454 \times 10^{-12}$ [Faradios] //

- $\frac{C}{C_0} = k_e$; $\frac{C}{k_e} = C_0$; $C_0 = \frac{13.3454 \times 10^{-12}}{4} = 3.3363 \times 10^{-12}$ [Fara

- $C = \frac{q}{V_{ab}}$; $q = CV_{ab}$; $q = (13.3454 \times 10^{-12})(500) = 6.6727 \times 10^{-9}$ [Fara]

- $E_{alm} = \frac{1}{2} C V_{ab}^2 = \frac{1}{2}(13.3454 \times 10^{-12})(500)^2 = 1.6681 \times 10^{-6}$ [J]

- $E_{almo} = \frac{1}{2} C_0 V_{abo}^2 = \frac{1}{2}(3.3363 \times 10^{-12})(2000)^2 = 6.6726 \times 10^{-6}$ [J]

- $V_{ar_1} = \frac{q}{4\pi\varepsilon}\left(\frac{1}{a} - \frac{1}{r_1}\right) = \frac{(6.6727 \times 10^{-9})}{16\pi(8.85 \times 10^{-12})}\left(\frac{1}{.02} - \frac{1}{.04}\right) = 562.4963$ [V]

- $V_{ar_2} = V_{ab}$; $r_2 \geq b$; $V_{ar_2} = 500$ [V]

- $V_{ar_3} = 0$; $r_3 \leq a$

- $\frac{(V_{ar_4})(4\pi\varepsilon)}{q} = \left(\frac{1}{a} - \frac{1}{r_4}\right)$; $\frac{1}{r_4} = \frac{1}{a} - \frac{V_{ar_4}(4\pi\varepsilon)}{q}$;

$$r_4 = \frac{1}{\frac{1}{a} - \frac{(V_{ar_4})(4\pi\varepsilon)}{q}} = \frac{1}{\frac{1}{.02} - \frac{(200)(4\pi)(8.85 \times 10^{-12})}{6.6726 \times 10^{-6}}} = .02727 \text{ [m]}$$

$$r_5^* = \frac{1}{\frac{1}{a} - \frac{(V_{ar_5})(4\pi\varepsilon)}{q}} = \frac{1}{\frac{1}{.02} - \frac{(600)(4\pi)(8.85 \times 10^{-12})}{6.6726 \times 10^{-6}}} = .1 \text{ [m]}$$

* El valor no está en la esfera

2.0

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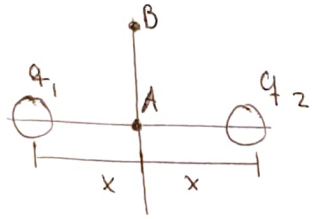
4]



DATOS	CALCULAR
$q_1 = 2 \times 10^{-8}$ [C]	$V_A =$
$q_2 = -3 \times 10^{-8}$ [C]	$V_B =$
$x = .1$ m	$V_{AB} =$
$y = .15$ m	

- $V_{ab_A} = K\left(\frac{q_1}{a} + \frac{q_2}{b}\right) = (9 \times 10^9)\left[\frac{2 \times 10^{-8}}{.1} + \frac{(-3 \times 10^{-8})}{.1}\right] =$

$= 4900$ [V]

- $V_{ab_B} = K\left(\frac{q_1}{a} + \frac{q_2}{a}\right)$ $\quad a = \sqrt{(.1)^2 + (.15)^2} = \frac{\sqrt{13}}{20}$

$= (9 \times 10^9)\left[\frac{(2 \times 10^{-8})}{\frac{\sqrt{13}}{20}} + \frac{(-3 \times 10^{-8})}{\frac{\sqrt{13}}{20}}\right] = -499.23$ [V]

- $V_{AB} = V_A - V_B$

$= [4900 \text{ [V]} - (-499.23)] = 5400.76$ [V]

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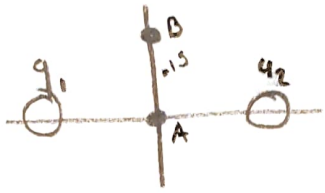
ASIGNATURA: Electricidad y Magnetismo GRUPO: 1 Exame_núm.: 2°

ALUMNO: Nurrieta Villegas Alfonso FECHA: 10 / /

DATOS

- $q_1 = 2 \times 10^{-8}$ [C]
- $q_2 = -3 \times 10^{-8}$ [C]
- $x = 10$ cm $= .1$ [m]
- $y = 15$ cm $= .15$ [m]

Esquema



Incognitas

$V_A = ¿? = -900$ [V]

$V_B = ¿? = -499.2511$ [V]

$V_{AB} = ¿? = -400.7489$ [V]

- $V_A = V_{abA} = (K)\left(\frac{q_1}{a} - \frac{q_2}{b}\right) = (9 \times 10^9)\left(\frac{2 \times 10^{-8}}{.1} + \frac{-3 \times 10^{-8}}{.1}\right) = -900$ [V]

- $V_B = V_{abB} = (K)\left(\frac{q_1}{a} - \frac{q_2}{b}\right) = (9 \times 10^9)\left(\frac{2 \times 10^{-8}}{.180277} + \frac{-3 \times 10^{-8}}{.180277}\right) = -499.2511$ [V]

- $V_{AB} = V_B - V_A = (-900) - (-499.2511) = -400.7489$ [V]

En el caso de V_B

Pitágoras; hipo $= x = \sqrt{(.1)^2 + (.15)} = .180277$

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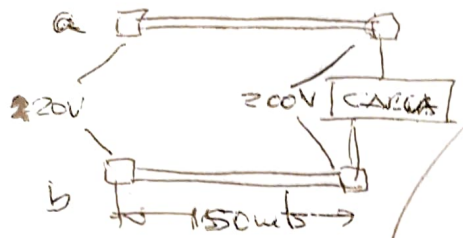
FACULTAD DE INGENIERIA
DIVISION DE CIENCIAS BASICAS
DEPARTAMENTO DE FISICA
ELECTRICIDAD Y MAGNETISMO
TERCER EXAMEN PARCIAL

7-MAYO-19
13-MAYO-19

Murrieta Villegas Alfonso

Problema 1



$\rho_{Cu} = 1.72\times10^{-8}\ \Omega\text{-m}$

$\alpha_{Cu} = 3.93\times10^{-3}\ °C^{-1}$

temp amb = 20°C

CARGA 250 foco de 150 Watts 220 Volts

$R_{foco} = ?$

$R_{foco\ eq.} = ?$

$A_{cond} = ?$ para cumplir una caída máxima de 20V

$i = ?$

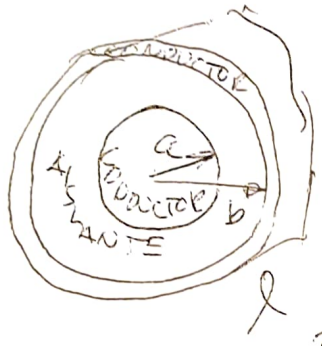
Pot disipada en los conductores

Pot disipada en la carga

Pot entregada al circuito

R_{cond} a 50°C

Problema 2



$V_{ab} = 24{,}160$ Volts.

$a = 5$ cm

$b = 10$ cm

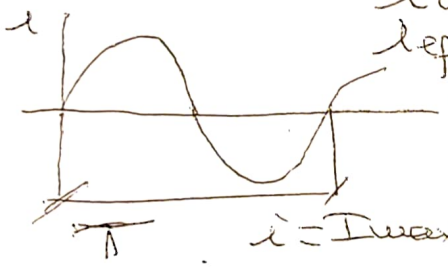
Calcular

$R_{aislante} = ?$

$i_{fuga} = ?$

Pot disipada en el aislante $= ?$

Problema 3

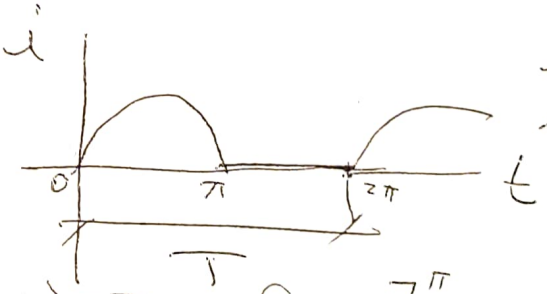


$i_m = ?$

$i_{ef} = ?$

$f = 60$ cps.

$i = I_{max} \operatorname{sen} \omega t$



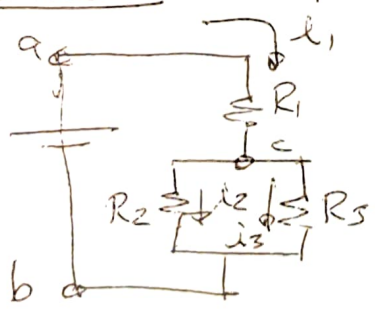
$i_m = ?$

$i_{ef} = ?$

$i = I_{max} \operatorname{sen} \omega t \Big]_0^{\pi}$

$i = 0 \Big]_{\pi}^{2\pi}$

Problema 4



$V_{ab} = 12V$

$R_1 = 4\Omega$

$R_2 = 3\Omega$

$R_3 = 6\Omega$

Calcular

i_1

i_2

i_3

V_{ac}

V_{cb}

R_{eq}

$Pot_{disip\ R_1} = ?$

$Pot_{disip\ R_2}$

$Pot_{disip\ R_3}$

$Pot_{disip\ R_{eq}}$

$Pot_{entregada} = ?$

Problema 5: Demostrar que

$J = \sigma E$ igual a $V = R i$

UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

EXAMEN: 3° Parcial

PROFESOR: Agustin Perez Contreras

MATERIA: Electricidad y Magnetismo

NOMBRE DEL ALUMNO: Morrieta Villegas Alfonso

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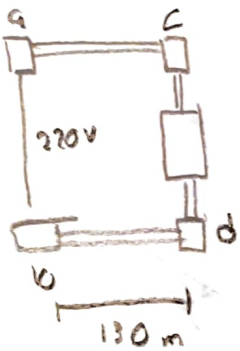


▸ Datos

- $\hat{\rho}_{cu} = 1.77 \times 10^{-8}$
- $\alpha_0 = 3.93 \times 10^{-3} \frac{1}{C}$
- $t_{cm\ at} = 20°C$
- 250 Focos
- 150 [W]
- 220 [V]

▸ A buscar

- R focos
- R focos eq
- A cond
- P disipada en conductor
- P disipada en la carga
- P en circuito

• $R_{ac} = \frac{\hat{\rho}_{ac} l_{ac}}{A_{ac}}$; $R_{db} = \frac{\hat{\rho}_{db} l_{db}}{A_{db}}$ $\quad \hat{\rho}_{ac} = \hat{\rho}_{db} = \hat{\rho}_{cu}$

• $V_{ac} + V_{ad} + V_{db} = V_{ab}$

• $P = i^2 R = \frac{V^2}{R}$; $R = \frac{V^2}{P}$

$\therefore R_{foco} = \frac{(200)^2}{150} = 322.6 [\Omega]$

$\frac{1}{R_{eq}} = \frac{250}{\frac{(220)^2}{150}} = \frac{375}{484} =$

$\therefore R_{eq} = \frac{484}{375} \cong 1.2906 [\Omega]$

$\therefore V_{cd} = i R_{foco}$; $i = \frac{V_{cd}}{R_F} = \frac{200[V]}{1.2906} = 154.96 [A]$

$V_{ac} = i R_{ac}$

$V_{db} = i R_{db}$; $2 V_{ac} + V_{cd} = V_{ab}$; $V_{ac} = \frac{V_{ab} - V_{cd}}{2}$

$V_{cd} = i R_{cd}$

$\therefore V_{ac} \quad \frac{220 - 200}{2} = 10 [V]$

continua en 2 →

$V_{ac} = i R_{con}$; $V_{ac} = i \frac{\hat{\rho} l}{A}$;

$\rightarrow A = \frac{i \hat{\rho} l}{V_{ac}} = \frac{(154.96)(1.72 \times 10^{-8})(150)}{10} \cong 39.977 \times 10^{-6} [m^2]$ //

$\rightarrow R_{cond} = \frac{\hat{\rho} l}{A} = \frac{(1.72 \times 10^{-8})(150)}{39.977 \times 10^{-6}} = .0645 [\Omega]$ //

$\rightarrow P_{\text{disipada conductor}} = \frac{(V_{ac})^2}{R_{cond}} = \frac{(10 [V])^2}{.0645} = 1550.3878 [W]$ //

$\rightarrow P_{carga} = \frac{(V_{cd})^2}{R_{focos}} = \frac{(200)^2}{1.2906} = 30993.33 [W]$ //

$\rightarrow P_{\text{entregada}} = V_T i = (220 [V])(154.96) = 34091.2 [W]$ //

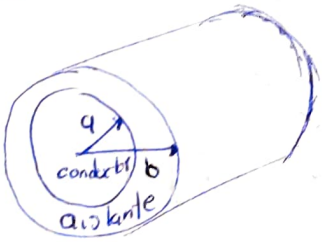
$R_{20} = R_0 (1 + 20 \alpha_0)$; $R_{20} = .0645 [\Omega]$

$R_{50} = R_0 (1 + 50 \alpha_0)$; $\alpha_{cu} = 3.93 \times 10^{-3} [°C]^{-1}$

$\therefore R_{50} = R_{20} \left(\frac{1 + 50 \alpha_0}{1 + 20 \alpha_0} \right) = (.0645) \left(\frac{1 + (50)(3.93 \times 10^{-3})}{1 + (20)(3.93 \times 10^{-3})} \right) =$

$\therefore R_{50} = .07155 [\Omega]$ //

2]



- $V_{ab} = 4.160 [V]$
- $a = 5$ cm
- $b = 10$ cm

Calcular

- $R_{aislante} =$
- $i_{fuga} =$
- $P_{\text{disipada aislante}} =$

$dR = \frac{\hat{\rho} dl}{A}$; $R = \int_a^b \frac{\hat{\rho} dr}{A} = \hat{\rho} \int_a^b \frac{dr}{r} =$

$\therefore R = \frac{\hat{\rho}}{2\pi l} \ln\left(\frac{b}{a}\right) = \frac{\hat{\rho} \ln\left(\frac{.1}{.05}\right)}{2\pi l}$ //

$A = 2\pi l r$

$2\pi r = \pi d$

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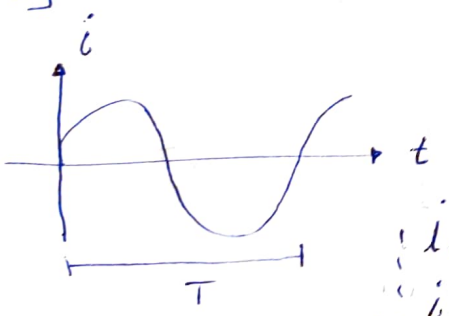
$$\therefore i_{fuga} = \frac{V_{ab}}{R_{aislante}} = \frac{4.16}{\frac{\rho \ln\left(\frac{.1}{.05}\right)}{2\pi l}} \; [A]$$

$$P_{dis\,aislante} = i V = \frac{(4.16)(2\pi l)}{(\rho)[\ln(\frac{.1}{.05})]}(4.16)$$

$$= \frac{156.87 \times 10^{6}\, l}{\rho} \; [W]$$

3]



$i = I_{max} \operatorname{sen} \omega t$

Datos

~~$T = 2\pi$~~

$f = 60$ cps

$T = \frac{1}{60}$

$i_{media} = ¿?$

$i_{ef} = ¿?$

$$\rightarrow i_{media} = \frac{1}{T}\int i\,dt = \frac{1}{T}\int_0^{2\pi} i_{max} \operatorname{sen}(\omega t)\,dt =$$

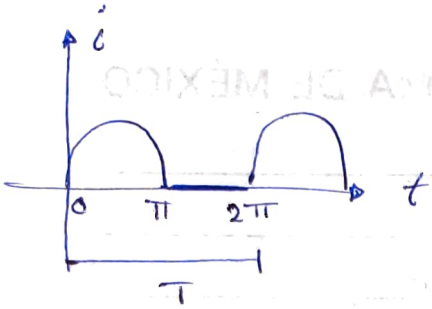
$$= \frac{i_{max}}{T}\int_0^{2\pi} \operatorname{sen}\omega t\,dt = \frac{i_{max}}{T}\left[\cancel{-\cos\omega t\Big|_0^{2\pi}}\right]^{0} = 0$$

$$\rightarrow i_{eficaz}^2 = \frac{1}{T}\int i^2\,dt = \frac{1}{T}\int_0^{2\pi}(i_{max}\operatorname{sen}(\omega t))^2\,dt =$$

$$= \frac{i_{max}^2}{T}\int_0^{2\pi}\left(\frac{1}{2} - \frac{1}{2}\cos 2\omega t\right)dt = \frac{i_{max}^2}{T}\left[\frac{1}{2}t - \cancel{\frac{1}{4\omega}\operatorname{sen}2\omega t}\right]_0^{T}$$

$$= \left[\frac{i_{max}^2}{\cancel{T}}\right]\left[\frac{1}{2}\cancel{T}\right] = \frac{i_{max}^2}{2}$$

$$\therefore i_{ef} = \frac{i_{max}}{\sqrt{2}}$$



- $i = I_{max} \operatorname{sen} \omega t \Big]_0^{\pi}$
- $i = 0 \Big]_{\pi}^{2\pi}$
- $i_{media} = ¿?$
- $i_{eficaz} = ¿?$

- $T = 2\pi$ • $\omega = \frac{2\pi}{2\pi} = 1$

$$i = \begin{cases} i_{max} \operatorname{sen} \omega t & 0 \le t \le \pi \\ 0 & \pi \le t \le 2\pi \end{cases}$$

- $i_m = \left(\frac{i_{max}}{\omega T}\right)\left[-\cos \omega t\right]\Big|_0^{\pi}$

$$= \left(\frac{i_{max}}{\cancel{\omega T}}\right)(\cancel{2}) = \frac{i_{max}}{\pi} \; [A]$$

$\omega T \to 2\pi$

- $i_{ef}^2 = \frac{1}{2\pi}\int_0^{\pi} (I_{max} \operatorname{sen} \omega t)^2 \, dt = \frac{I_{max}^2}{2\pi}\int_0^{\pi} \frac{1}{2} - \frac{1}{2}\cos(2\omega t)\, dt =$

$$= \left[\frac{I_{max}^2}{2\pi}\right]\left[\frac{1}{2}t - \frac{1}{4\omega}\operatorname{sen} \omega t \Big|_0^{\pi}\right] =$$

$$= \left[\frac{I_{max}^2}{2\pi}\right]\left[\frac{1}{2}(\pi) - \frac{1}{4\omega}\left[\cancel{\operatorname{sen}\pi - \operatorname{sen} 0}\right]^{0}\right] = \frac{I_{max}^2}{4}$$

$$\therefore i_{ef} = \frac{I_{max}}{2} \; [A]$$

2.0

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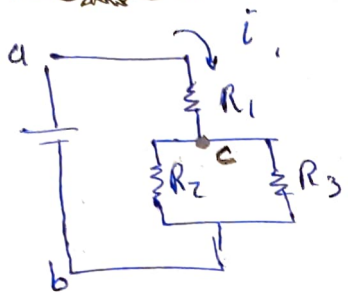
4]



$V_{ab} = 12\ V$

- $R_1 = 4\ \Omega$
- $R_2 = 3\ \Omega$
- $R_3 = 6\ \Omega$

Calcular

- $i_1 = ¿?$
- $i_2 = ¿?$
- $i_3 = ¿?$
- V_{ac}
- V_{cb}
- R_{eq}
- $P_{dis\,R_1}$
- $P_{dis\,R_2}$
- $P_{dis\,R_3}$
- $P_{dis\,R_{eq}}$

$$R_{23} = \left(\frac{1}{R_2} + \frac{1}{R_3}\right)^{-1} = \left[\frac{1}{\frac{1}{6} + \frac{1}{3}}\right] = 2\ [\Omega]$$

$$\rightarrow R_{eq} = R_1 + R_{23} = 4 + 2 = 6\ [\Omega]$$

$$V_{ab} = i\,R_{eq}$$

$$\rightarrow i = \frac{V_{ab}}{R_{eq}} = \frac{12}{6} = 2\ [A]$$

$$\rightarrow V_{ac} = i\,R_1 = (2)(4) = 8\ [V]$$

$$\rightarrow V_{cb} = i\,R_{23} = (2)(2) = 4\ [V]$$

// Comprobando

$$V_{ab} = V_{ac} + V_{cb}$$

$$12 = 8\ [V] + 4\ [V] = 12\ [V]$$ ✓

$$i_{eq} = i_1$$

$$\rightarrow i_2 = \frac{V_{cb}}{R_2} = \frac{4\ [V]}{3\ [\Omega]} = 1.333\ [A]$$

$$\rightarrow i_3 = \frac{V_{cb}}{R_3} = \frac{4\ [V]}{6\ [\Omega]} = .667\ [A]$$

// Comprobando

$$i_1 = i_2 + i_3$$

$$2 = 1.333 + .667 = 2\ [A]$$ ✓

20

// POTENCIAS

$$\rightarrow P_{ot\,dis\,R_1} = i_1^2 R = (2)^2(4) = 16\ [W]$$

$$\rightarrow P_{d\,R_2} = (1.33)^2(3) = 5.33\ [W]$$

$$\rightarrow P_{dis\,R_3} = (.667)^2(6) = 2.667\ [W]$$

$$P_{dis\,R_{eq}} = (2)^2(6) = 24\ [W]$$

$$P_{entregada} = (i)(V_{ab}) = (2)(12) = 24\ [W]$$

5] Demostrar que $J = \bar{\sigma} \cdot \bar{E} = V = iR$

$\bar{\sigma} \triangleq$ Cond. eléctrica

$\bar{E} \triangleq$ Campo eléctrico

$$J = \frac{di}{dA} \; ; \; \frac{di}{dA} = \bar{\sigma} \cdot \bar{E} \; ; \; di = \bar{\sigma}\bar{E}\, dA \; ; \; \int_0^i di = \int_0^A \bar{\sigma}\bar{E}\, dA \; ;$$

$$i = \bar{\sigma} E A$$

$$i = \bar{\sigma} A - \frac{dv}{dx}$$

$$E = -\bar{\nabla} v \; ; \; \bar{\nabla} v = \frac{dv}{dx} \qquad E = -\frac{dv}{dx}$$

$$\int_a^b -dv = \int_{x_a}^{x_b} \frac{i}{\bar{\sigma} A}\, dx \; ; \; -(V_b - V_a) = \frac{i}{\bar{\sigma} A} \underbrace{(x_b - x_a)}_{l}$$

$$\sigma = \frac{1}{\hat{\rho}} \; ; \; \hat{\rho} = \frac{1}{\bar{\sigma}}$$

$$\therefore V_{ab} = i\left(\frac{l}{\bar{\sigma} A}\right)$$

$$\rightarrow V_{ab} = i\left(\frac{\hat{\rho} l}{A}\right)$$

$R \triangleq$ Resistencia eléctrica $= \dfrac{\hat{\rho} l}{A}$

$\therefore V_{ab} = \underline{iR}$ //

$\therefore$ Ambas expresiones son iguales //

2,0